IGS03-02
CLOSEOUT

IP7_033665

INTERMOUNTAIN POWER SERVICE CORPORATION

CAPITAL PROJECT #IGS03-02

W.O. # 03-96032-0 Date November 4, 2003

PROJECT APPROVAL	Title: Air Heater Element Replacement Budget Source: 2003-2004 Identified Capital Projects Superintendent Technical Services Signed: [signature] Dated: 11-7-03 IPSC Pres. & COO Approval Signed: [signature] Dated: 11/10/03 Route: 1. Package to Operations for approval to proceed (signature below) 2. Requisitions and copy of signed approval form to Purchasing
PROJECT INFORMATION	IPSC Contact: Bret Kent Ext. 6447 Total Est. Costs: $4,252,123 Scheduled Start: 12/1/03 (Mtl: $3,152,123 Labor: $1,100,000 Engring.$)
INSTALLATION	`Preconstruction Appvl (Oper.) _____ Date _____ Tagging 'CONSTRUCTION' update N/A Date _____ Work Pkg. to Planning (Engr.) N/A Date _____ QA/QC Completion (QA/QC Engr. Bret Kent Date 4/1/05 Startup Complete (IPSC Engr.) Bret Kent Date 4/1/05 Install. Complete (Planner) N/A Date _____ As-Built Pkg to Engr. (Planner) N/A Date _____ Released to Oper. (IPSC Engr.) Bret Kent Date 4/1/05
PROJECT CLOSEOUT	Closeout Complete (IPSC Engr.) Bret Kent Date 3-6-06 Tagging 'AS-BUILT' update N/A Date _____ Project Complete (GWC) GWC Date 3/7/06

IP7_033666

MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross

FROM: Dennis K. Killian

DATE: November 7, 2003

SUBJECT: Revised Economics for SAH Element Replacement
Capital Project IGS03-02

In accordance with the Letter of Intent issued to Alstom Power Air Preheater Company for purchasing SAH Hardware, we are providing the following updated economic justification which takes into consideration the cost escalation of the project. The original budgeted amount for hardware was $2,400,000 (both units). The increased amount as shown on the Letter of Intent is $2,999,100. The primary reasons for the increase came from the cost of the replacement element material and a 60 percent increase in the number of transport trucks.

Benefit/Cost: 2.92
Rate of Return: 33%
Payback Period: 3.3 Years
Economic Life: 15 Years
PV Savings: $29,944,877

We have $1,750,000 budgeted for this project in 2003-04 and Alstom has agreed to defer a payment to insure that we stay under budget. The budget for 2004-05 will have to be increased to cover the deferred payment and the increase in that year. We will postpone or reduce the scope of other projects to make sure that the 2004-05 budget remains under the amount on the preliminary budget submitted in September.

Four requisitions have been created to date for the associated costs of this project.

190854: Requisition for hardware based on original Alstom bid - $2,405,200
194448: Requisition for installation - $1,100,000
194468: Requisition for additional cost of hardware per Alstom proposal 3GS-1034B - $410,925
194470: Requisition for transportation cost - $336,100

Attached to this memo:

Requisition 194468 for your approval.
Requisition 194470 for your approval.
Updated Capital Project Package for your approval.

Any questions regarding this project may be directed to Bret Kent at ext. 6447.

DBK/JKH:jmg

Attachments

CAPITAL PROJECT JUSTIFICATION 2003 -2004

JOB.NO: IGS03-02 W.O. # 03-96032-0

TITLE: Secondary Air Heater Element Replacement

DESCRIPTION: Project includes replacement of the aging secondary air heater elements with a newer technology offered by the OEM. In addition, new seals and mechanical seal clearance gauges will be installed. This would commence with Unit 2 during the 2004 scheduled outage and finish with Unit 1 in 2005.

JUSTIFICATION: Economic

BENEFIT/COST RATIO: 2.92
RATE OF RETURN: 33%
PAYBACK PERIOD: 3.30 years
ECONOMIC LIFE: 15 years
PV SAVINGS: $29,944,877
SALVAGE VALUE: $0

ADDITIONAL DETAIL: There are several advantages to the Alstom ClearFlow upgrade.

First, the ClearFlow upgrade will eliminate the support grating between the soot blower and the element sheets used to support each element. Instead, stay plates installed between the diaphragms will carry the element baskets. Presently, the area behind the support grating bars is not easily cleaned, as a result of obstructions to the cleaning media.

Secondly, going to the two layer element design isolates the fouling zone to the cold end layer. Since this area is where the soot blowing energy is maximized, fouling is conversely minimized. When the soot blowing media leaves the element layer, the media energy dissipates to the sides and energy is lost rapidly. This occurs on each layer, so consequently in a three layer design the intermediate layer receives less cleaning energy and the hot end layer significantly less. In most cases, a ClearFlow up-grade requires less soot blowing frequency and lower soot blowing pressures thereby extending the life of the heating element.

Lastly, with reduced obstruction and better cleanout, the fan power requirements are cut. This not only saves in power costs, but in the

mechanical life of the fan.

A ClearFlow upgrade could use several different types of heating elements. Since each element profile is designed for a particular fuel or fouling problem, the optimized selection (for the proposed replacement) are the DL7 elements. The DL7 are a loose pack element, similar to the existing DL profile, but with a higher thermal performance, allowing a drop from 3 layers to 2.

Another option available with the ClearFlow up-grade is not only turning over (or flipping) the element baskets, as with the present heaters, but because both the hot end and cold end layers are the same depth (41"), the hot and cold end layers can be switched as the elements wear. This allows for more even wear on the hot and cold ends of each layer.

COST ESTIMATE:	Installation Labor	$ 1,100,000
	Material	$ 2,663,000
	Taxes	$ 153,123
	Freight	$ 336,000
	Job Total	$4,252,123

ALTERNATIVES: In-kind Replacement would consist of replacement of DL elements and general air heater refurbishment. It would restore the air heaters to design specifications. Lost performance would be regained, but no additional capability provided.

EFFECT OF DEFERRAL: Lost savings. Eventual structural failure and loss of efficiency.

LADWP REQUIRED SUPPORT: None

PROJECT HISTORY:

Aging of air heater heat transfer elements have raised questions regarding both performance and structural integrity of the transfer surface. Significant advances in air heater technology, since initial installation, now afford us valuable alternatives for air heater and system performance improvement.

CAPITAL PROJECT JUSTIFICATION 2003 -2004

An assessment of the secondary air heaters shows that upgrade of the element systems on these heaters will provide both performance and reliability benefits.

There are only two alternative designs currently available for consideration for element replacement. These are:

- Air Preheater Company's (Alstom) replacement-in-kind
- Air Preheater Company's (Alstom) ClearFlow® upgrade

IPSC

INTERMOUNTAIN POWER SERVICE CORPORATION

Document Tracking Form

Capital Project No.: IGS03-02
Title: SAH Element Replacement
Prepared By: Bret Kent

IPSC Work Order # 03-96032-0
Date: May 25, 2005
Supervisor: Dean Wood

Item 1 - Construction Drawings

Drawing Number	Rev. No.	Comments	Tag (X)	Available in current, waiting closeout	Date Submitted for Closeout	Date Closed Out
None						

Item 2 - Manufacturer's Drawings

Drawing Number	Rev. No.	Comments	Available in current, waiting closeout	Date Submitted for Closeout	Date Closed Out
62.3401.05-90613	P	065357			8/9/04
62.3401.05-90614	0	10041587		3/7/06	
62.3401.05-90615	A	10021477		3/7/06	
62.3401.05-90616	0	098856			8/9/04
62.3401.05-90617	A	099297			8/9/04
62.3401.05-90618	0	099502			8/9/04
62.3401.05-90619	0	10031472			8/9/04
62.3401.05-90620	0	10031477			8/9/04
62.3401.05-90621	0	80030674			8/9/04
62.3401.05-90622	0	80030675			8/9/04

Item 3 - Instruction Manuals

Instruction Manual Number	Title	Vol.	Comments/ Instruction	Date Submitted for Closeout	Date Closed Out
9255.62.3401	Instruction Book for Steam Generator	V			
	Add the following documents to Section 17 of the above referenced manual				
	SAH Clearflow Modifications			3/7/06	
	Seal Setting Procedure			3/7/06	

Once close out package is approved, these changes will be routed to Repo for distribution to all Gray Books.

Item 4 - System Descriptions

IPSC

INTERMOUNTAIN POWER SERVICE CORPORATION

Document Tracking Form

Capital Project No.: IGS03-02
Title: SAH Element Replacement
Prepared By: Bret Kent

IPSC Work Order # 03-96032-0
Date: May 25, 2005
Supervisor: Dean Wood

System Code	System Title/Page	Comments/ Instructions	Date Submitted for Closeout	Date Closed Out

Item 5 - DATATRAK Revisions

Device Number	New/ Revised/ Deleted	Comments	Date Submitted for Closeout	Date Closed Out

Item 6 - I & C Database Revisions

Devise Number	New/ Revised/ Deleted	Comments	Date Submitted for Closeout	Date Closed Out

Item 7 - Ladder Logic Revisions

Devise Number	New/ Revised/ Network #	Comments	Date Submitted for Closeout	Date Closed Out

Item 8 - Relay Manual Updates

Manual and Page #	Relay #	Comments	Date Submitted for Closeout	Date Closed Out

IPSC

INTERMOUNTAIN POWER SERVICE CORPORATION

Document Tracking Form

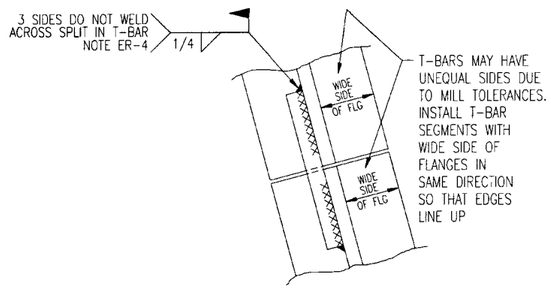
Capital Project No.: IGS03-02
Title: SAH Element Replacement
Prepared By: Bret Kent

IPSC Work Order # 03-96032-0
Date: May 25, 2005
Supervisor: Dean Wood
Page 3 of 3

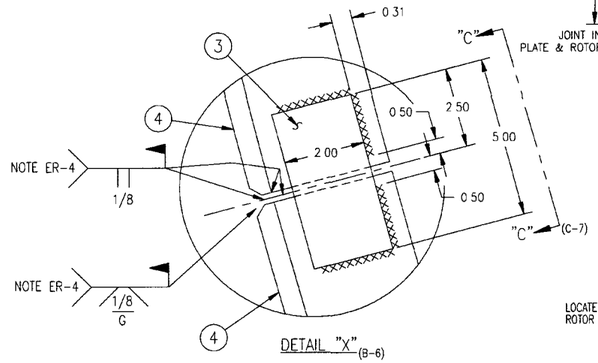
Item 9 - Miscellaneous Documentation

Description	Date Submitted for Closeout	Date Closed Out

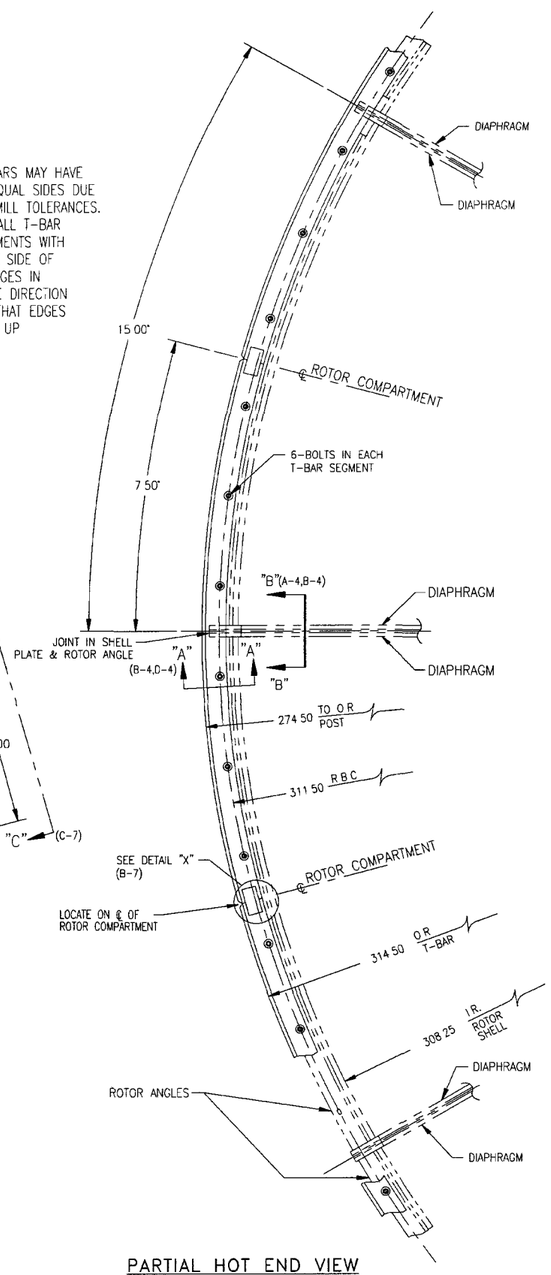
IP7_033674



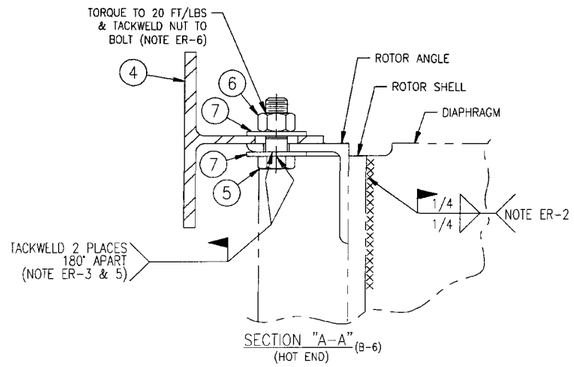
VIEW "C-C" (B-7)



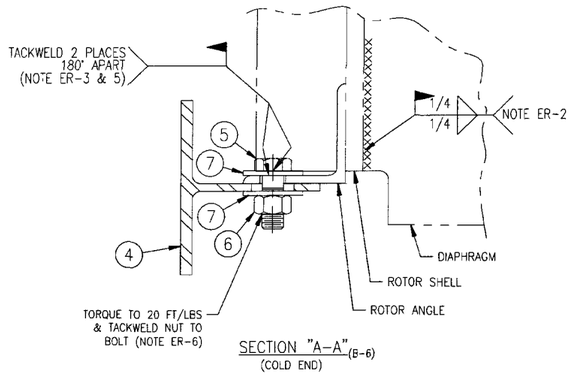
DETAIL "X" (B-6)



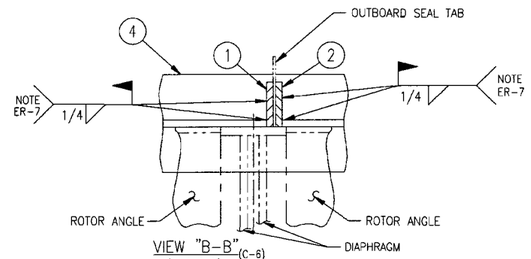
PARTIAL HOT END VIEW



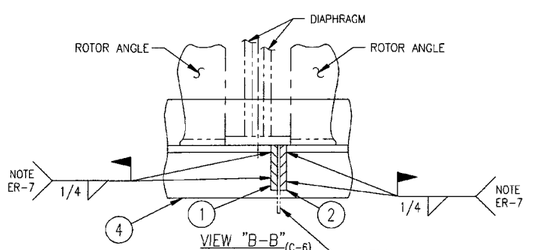
SECTION "A-A" (B-6)
(HOT END)



SECTION "A-A" (B-6)
(COLD END)



VIEW "B-B" (C-6)
(HOT END)



VIEW "B-B" (C-6)
(COLD END)

BILL OF MATERIAL

REF.	DRAWING NO.	QTY	MAT'L.	DESCRIPTION	S L
1	E-77351	48		T-BAR TAB	S L
2	E-77345	48		T-BAR TAB	S L
3	E-95943	48		SPLICE BAR	S L
4	B-77352	48		T-BAR (ASS'Y #3)	S L
5	P-14-31500	288	3201	0.63 X 1.75 HEX HEAD CAPSCREW	S L
6	P-10-1420	288	3205	0.63 FIN HEX NUT	S L
7	P-6-1289	576	3221	0.63 WASHER	S L

NOTES TO ERECTOR

ER-1 REMOVE EXISTING T-BARS AND T-BAR TABS

ER-2 INSPECT THE WELD BETWEEN THE ROTOR SHELL AND THE DIAPHRAGM FOR FRACTURES IF FRACTURES ARE FOUND, REMOVE THE EXISTING WELD TWO INCHES BEYOND THE END OF THE FRACTURE AND REWELD AS SHOWN IN SECTION "A-A"

ER-3 INSTALL THE T-BARS (REF #4) WITH THE ENDS LOCATED ON THE CENTER-LINES OF THE ROTOR COMPARTMENTS AND TO THE RADIUS SHOWN WITH A TOTAL RUN-OUT OF 0.13" ALL THE BOLTS, NUTS, AND WASHERS ARE TO BE INSTALLED EXACTLY AS SHOWN IN SECTION "A-A" TIGHTEN ALL BOLTS PRIOR TO WELDING

ER-4 WELD T-BARS (REF. #4) AND SPLICE BAR (REF #3) AS SHOWN IN DETAIL "X" AND VIEW "C-C"

ER-5 TACKWELD BOLT HEADS (REF #5) TO WASHERS (REF. #7) ACROSS FLATS 180° APART, AND THEN TACK WELD THE WASHERS TO THE ANGLES 180° APART FOR 0.75"

ER-6 BACK OFF NUTS (REF #6) AND THEN TORQUE TO 20 FT/LBS THEN TACK WELD BOLT TO NUT (DO NOT TACK WELD THE NUT TO THE WASHER OR WASHER TO THE T-BAR).

ER-7 WELD THE T-BAR TABS (REF #1 & #2) AS SHOWN IN SECTION "B-B" WELD TO THE T-BAR ONLY INSTALL REF. #1 ON TRAILING SIDE OF RADIAL SEALS AND REF #2 ON LEADING SIDE

This Drawing to Replace Existing Print

62.3401.05-90614

MARK	DATE	DR	CK	DESCRIPTION
H				
G				
F				
E				
D				
C				
B				
A				

ALTERATIONS

[4098/04064895]

SUPERSEDED BY

SUPERSEDES

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

THIRD ANGLE

ALSTOM

ALSTOM Power Inc.
Air Preheater Company
Wellsville, New York

SUBJECT AIR PREHEATER

API NO

SIZE 33.5 VI (MOD)

DR GP | CK DV

APPR BY

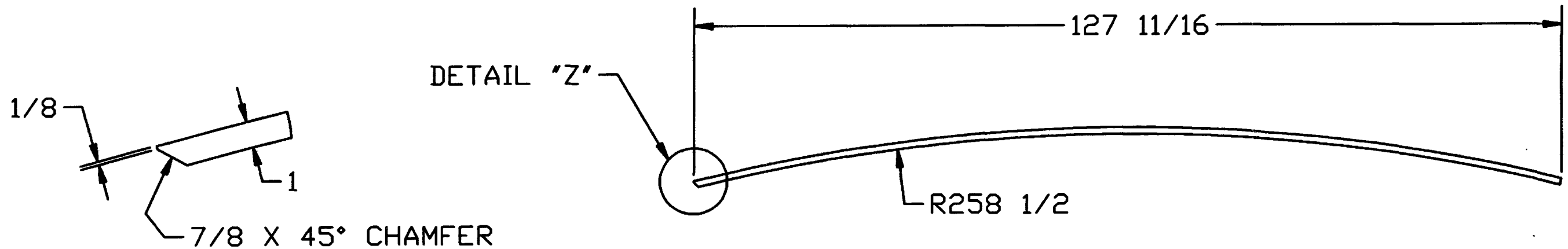
DATE 12/16/04

HOT & COLD END FLOATING T-BAR INSTALLATION

CODE	GROUP	SIZE	DWG NO	REV
ER	0103	D	10041587	

SCALE NTS | WT | SHEET OF

IP7_033675



DETAIL "Z"
(1 END ONLY)

DESCRIPTION: 1 X 8 X 128-3/4 ROLL TO 258-1/2 I.R.
MATERIAL: 40006

This Drawing to Replace Existing Print

62.3401.05-90615

MARK	DATE	DR.	CK.	DESCRIPTION
H				
G				
F				
E				
D				
C				
B				
A	10-31-02	JRL	RAD	CHANGED DIMENSIONS

ALTERATIONS

LJUNG/CONT/4399/NEW/0402

SUPERSEDED BY

SUPERSEDES

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

THIRD ANGLE

ALSTOM

ALSTOM Power Inc.
Air Preheater Company
Wellsville, New York

SUBJECT AIR PREHEATER

API NO.

SIZE 31 VI

DR JRL CK RAD

APPR. BY

DATE 10-7-02

TENSION RING

CODE	GROUP	SIZE	DWG NO.	REV
	0400	B	10021477	A

SCALE NTS WT SHEET OF

03062713

IP7_033676

SAH Clearflow Modifications
Capital Project: IGS03-02
Work Order: 03-96032-0

During the Spring outages of 2004 (Unit 2) and 2005 (Unit 1) the Secondary Air Heaters were modified to incorporate the Ljungstrom Air Preheater Clearflow Rotor upgrades. This work included rotor modifications (to accommodate new style heat transfer baskets) and installation of new heat transfer baskets.

The major change to the SAH's was the replacement of 4 layers of heat transfer baskets:

- Hot End Layer — #22 Ga. "DL" 36" Depth Low Alloy / Corrosion Resistant
- Hot Intermediate Layer — #22 Ga. "DL" 16" Depth Low Alloy / Corrosion Resistant
- Cold End Layer — #18 Ga. NF-6 13.5" Depth Low Alloy / Corrosion Resistant
- Cold Intermediate Layer — #22 Ga. "DL" 9.5" Depth Low Alloy / Corrosion Resistant

With 2 layers:

- Hot End Layer — #22 Ga. "DL7" 41" Depth Low Alloy / Corrosion Resistant
- Cold End Layer — #20 Ga. "DL7" 41" Depth Low Alloy / Corrosion Resistant

The other changes were require to accommodate the much larger style baskets and to provide better seals around baskets. In addition, the outside doors were skip welded shut, as side removal is not possible with the 41" tall baskets.

The following drawings were provided new as part of these modifications and can be found in the electronic drawing database:

VENDOR DWG	REV	APCO DWG	DESCRIPTION
62.3401.05-90613	P	65357	GENERAL WELDING SPECIFICATIONS
62.3401.05-90614	0	10041587	HOT & COLD END FLOATING T-BAR INSTALLATION
62.3401.05-90615	A	10021477	TENSION RING
62.3401.05-90616	0	098856	REFERENCE TABLE
62.3401.05-90617	A	099297	EE-ZEE(TM) BYPASS SEAL FIELD ASS'Y
62.3401.05-90618	0	099502	LIFTING ARRANGEMENT
62.3401.05-90619	0	10031472	CLEARFLOW ROTOR MODIFICATIONS
62.3401.05-90620	0	10031477	HOT END SEAL CLEARANCE GAUGE ASS'Y
62.3401.05-90621	0	80030674	BASKET ARRANGEMENT
62.3401.05-90622	0	80030675	BASKET SEALING BAR ARRANGEMENT

Relevant drawing to this modification that were not altered:

VENDOR DWG	REV	APCO DWG	DESCRIPTION
62.3401.05-90049	A	78077	SEC AIR HEATER RADIAL SEALS ASSEMBLY #3
62.3401.05-90044	0	78075	SEC AIR HEATER AXIAL SEALS ASSEMBLY #1
62.3401.05-90034	A	935428	SECONDARY AIR HEATER ROTOR ASSEMBLY #1

SEAL SETTING PROCEDURE
INTERMOUNTAIN POWER SECONDARY PREHEATERS
LAP-4098 & LAP 4100
Rev 0

1.0 Overview

Because the SAH's at the IPP site have the following existing conditions/modifications a special seal setting procedure is required to obtain satisfactory sealing.

- Hot end sector plates distorted as a result of fly ash entrapment.
- The addition of the electrical controls to establish "Mandatory Retract Position" at ¼" above "Nominal Cold Position".
- Seal Leakage Control System is operated as a two position arrangement instead of the infinitely variable arrangement as originally supplied.

The first procedure will outline the steps required to replace and set hot end radial seals. The second procedure will outline the steps required to check and refine the relative hot end sector plate positions and verify how closely they are to being planer. Following these procedures will be a brief procedure for setting the cold end radial seals and axial seals.

1.1 Definitions:

A) Mandatory Retract Position: ¼" above "Nominal Cold Position"

B) Nominal Cold Position: "0" position on control panel: This is a bit arbitrary with the modifications that have been made to the Active Leakage Control System. With the control panel indicating "0", the sector plates should be in plane with each other and at an elevation of 3/8" to 1/2" above the high point of the hot end "T" bar.

C) Finger Tabs: Either purchased from APCO or made on site, these are bolted to the rotor diaphragms and adjusted for use as reference for relative positions of the various sealing surfaces (i.e. sector plates and axial seal plates).

D) Radial Seal Straight Edge: In this case a two piece length of aluminum channel used as a gage for setting hot and cold end radial seals. Note that the hot radial seals are set 1/8" below the faces of the hot sector plates at inboard and outboard ends and with a greater gap at the point where the straight edge is spliced near the mid span. This forms a shallow "V". The same straight edge assembly is used at the cold end, but the seals are set in a straight line from inboard to outboard ends.

E) Seal Setting Spacer: The recommendation is a 1/8" thick strap, 1" to 1-1/2" wide and cut long enough to grasp easily. One is held between each end of a given seal and the straight edge while setting the seals.

1.2 General Recommendations

A) It is recommend that the air supply and valves used to operate the air motor during seal setting be located conveniently in the duct and wired in place close to the work station. A minimum of 1" rubber air hose should be used for this purpose along with two valves in series – one a ball valve for manipulating the rotor and the other a gate valve as a safety back up for the ball valve. This will prevent accidental rotor rotation should someone accidentally snag the handle of the ball valve while people are working. The valves should be in a position to enable the operator to clearly see the relationship between seals and straight edge and to make sure no workmen are jeopardized by rotation.

B) Lift the electrical contact for the rotor stoppage alarm signal in the hot end sector plate drive control panels to permit manual operation of the sector plates. You can not run sector plates from the "Mandatory Retract" position unless this is done.

NOTE: Do not forget to re-attach rotor stoppage connections in the control panels once seal setting is completed.

C) During the process of setting the rotor seals, it is preferred not to set seals directly in contact with the seal straight edge. There are two reasons for this. First, should the rotor coast past the straight edge position while setting seals, the rotor may be turned 360 degrees to set the seals without any interference between the set seals and the straight edge. The second reason is that a more consistent seal setting is achieved because the only pressure on the straight edge is from the seal being set. Any seals previously set along the same diaphragm will have a gap with the straight edge once the spacers are removed. The recommendation is a 1/8" thick strap, 1" to 1-1/2" wide and cut long enough to grasp easily. One is held between each end of a given seal and the straight edge while setting the seals.

2.0 Hot End Radial Seals

2.1 Seal Setting Without Refining Sector Plate Position

A) Drive both sector plates down to the "Nominal Cold" or 0" position on the panel.

B) Pre-mount the two piece "Radial Seal Straight Edge" above one of the radial seals, and lift it up far enough to clear all remaining seals when the rotor is rotated. Note that the straight edge mounting brackets are already in place inside both the air inlet or gas outlet ducts.

C) Remove the radial seals from at least one rotor diaphragm and install finger tabs loosely in a position which will not interfere with the sector plates as the rotor is turned.. Finger tabs are to be installed on the leading face of the selected rotor diaphragm at the first or second outboard and inboard seal bolt holes as well as at the two seal mounting bolt holes adjacent the splice near the mid-span of the seal straight edge. In addition, a finger tab should be installed approximately three feet inboard of the outer finger tab location. This latter tab (second inner) is to check amount of deformity of the distorted hot end sector plate.

If working in the gas inlet duct, rotate the rotor until the diaphragm passes beneath the first sector plate and nearly across the face of the second sector plate, stopping just about 2" before emerging from beneath the second sector plate into the gas duct. Set the finger tabs to the face of the plate at this location. This sector plate will be the one which has not suffered distortion.

If the seal straight edge has been installed on the air outlet side, the diaphragm with the finger tabs will be stopped about 2" under the leading edge of the first sector plate in rotation, as this is the undistorted plate, and set to the face of the plate at this point.

NOTE: The prefered method for installing the finger tabs is in such a way that they extend upward at about a 45 degree angle. Then snug the bolts sufficiently to hold them in place, but not so tightly that the tabs will not rotate as a result of contact with the sector plate surfaces.

D) Rotate the rotor enough so that the finger tabs have traversed across the faces of both sector plates. Scribe a line across the face of the finger tabs at the top of the diaphragm as a reference. Tighten the mounting bolts for the finger tabs, making certain the tabs do not move by referring to the scribed line. Accomplish a second rotation while watching the finger tabs traverse both sector plates. If you observe significant gaps at inboard and/or outboard end locations the sector plates, the positions will require refining. Absent that, return the diaphragm with the finger tabs to the seal straight edge position and prepare to set the straight edge.

E) Lower the seal straight edge sections down so they are just in contact with the finger tabs. Tighten the mounting bolts for the straight edge at the ends and center location. Note at this point, the gap between second inner finger tab and the face of the straight edge. This is the amount of distortion of the damaged sector plate assuming the inner and outer tabs were in close contact with both sector plates during the traverse.

F) Refer to the seal setting chart from in this O&M manual.

G) Loosen the seal straight edge mounting bolts and lower the straight edge down to the new position in contact with the finger tabs at inner and outboard ends. Tighten.

NOTE: This should be the final elevation position of the straight edge at inboard and outboard ends, if the 1/8" spacers are used to set seals as recommended.

H) Proceed to the seal straight edge center span splice location and repeat. Now referring to your seal setting chart, select a spacer equivalent to the depth of the specified (V) dimension at the center span, and tap the finger tabs down until the spacer will just fit between the straight edge and the tips of the finger tabs. Now lower the seal straight edge to the tops of the finger tabs and tighten in place.

NOTE: The radial seal straight edge is now in its final position and sits 1/8" higher than the correct elevation of the tops of the hot radial seals. To set the seals at their correct elevation it is therefore necessary to employ a 1/8" spacer near each end of a given seal, between every seal as it is set and the face of the straight edge. To reiterate; this assures that should the rotor coast past the setting location, during rotor indexing, the rotor may be rotated around again to the straight edge without any contact between seals & the straight edge. It also assures a more consistent seal setting by eliminating any pressure against the straight edge from any seal except the one being set.

2.2 Refining Elevation of Hot End Sector Plates

Assume that while sweeping the hot end sector plates with the finger tabs, it is found that the sector plates are out of plane enough to require re-setting. This could be either a simple elevational change or correcting a tilt of the plate relative to rotation.

To assist in determining which procedure to follow, add another outer finger tab on the diaphragm following the procedure used to setup the first finger tabs. This is accomplished by rotating the first tab beneath the sector plate; taking a reading with feeler gages; rotating the following diaphragm to the same location and setting a finger tab to the same reference point with the same feeler gage reading. You now have two finger tabs in plane with each other and on opposite sides of the same plate. These are then used as reference points for the following procedures:

A) Correction of elevation required; This simply requires the drive of offending sector plate be manually operated at the control panel in the required direction until the face of the plate is in plane with that of the opposite plate. The elevation indicator on the panel is then re-set to zero (nominal cold position). The maximum retract and maximum deformation indicators on the panel may also require re-setting. It may also be necessary to re-set the rotary limit switches at the Duff Norton jactuators.

B) Correcting a tilted condition; This requires that one of the Duff-Norton jactuators be un-coupled from the gear box. The remaining side is then manually driven at the control panel until it is planer with the uncoupled side. The jactuator is then re-coupled. The elevation may now be refined and the indicator re-set on the control panel to 0" as described above. The maximum retract and maximum deformation indicators in the panel and on the Duff Norton jactuators may also require re-setting.

C) If the elevation of the inboard ends of the sector plates are out of plane there could be two reasons.

i) One of the sector plates may not have followed the hot end spool back down. A check of the gap between the face of the sector plates and spool flange will disclose whether this is the case. To correct, it will be necessary to free up the sector plate static seals and re-set the hold down bracket within the ceramic wool packed seal at the inner end of the sector plate.

ii) If the hot end spool is tipped out of level it would be better to have an OEM service representative on site to correct.

3.0 Other Seals

3.1 Cold End Radial Seals

The procedure for setting the cold end radial seals is relatively simple when compared to the hot radials as outlined above. This is due to the fact the seals are set to a clearance in the cold condition and subsequently make contact with the sealing surfaces only at operating temperatures. Also, the cold end sector plates are supported from the cold end structure and have no driving system. Therefore, once the sector plates have been set in-plane with each other they will normally require no further adjustment. The only scenarios this may not hold true:

- If there has been a fire or other problem which may have warped the supporting structure.
- If there was a bearing failure which resulted in severe wear to a given sector plate.

Working at the cold end of the preheater normally requires building a scaffold. The top of the scaffold platform should be roughly six feet below the cold end of the rotor to provide easy access to seal bolting and to keep interference between human parts and rotating members to a minimum.

To set the seal straight edge up for the cold end it is necessary to:

A) Remove the radial seals from one diaphragm of the rotor and pre-hang the seal straight edge down below interference with any rotating member.

B) Rotate the selected diaphragm to a point about 2" in from the leading edge and above the face of first sector plate.

C) Set the finger tabs (inboard, outboard and center) against the face of the sector plate and tighten in position at about a 45 degree angle. Again it is preferred to tighten them only enough to hold in place.

D) Observe the traverse of the finger tabs across the faces of both sector plates. If plates are within tolerance (within 1/16" of plane with each other), rotate the finger tabs to the straight edge location and continue with set up.

E) Raise the seal straight edge and tighten in place, using the spacers you will use while setting seals as a spacer between finger tabs and straight edge. (Recommended spacer is 1/8" thick x 1" to 1-1/2" wide strap cut long enough to grasp easily.) Tighten the straight edge mounting bolts.

F) Refer to the seal setting chart in this O&M Manual. Select spacers equivalent to the outboard seal gap and equivalent to one half of

the outer dimension to be used for the center straight edge splice location. The inboard seal setting is 0" so the only positions requiring elevation adjustment are the two at center span and the outboard location.

G) Loosen each of the three finger tabs in turn, insert the appropriate seal dimension spacer and re-tighten the finger tab bolts with the tabs at the raised position.

H) Loosen the straight edge mounting bolts and raise the straight edge so it is in contact with the two center and the outer finger tabs.

I) The seals may now be set to the straight edge using your 1/8" thick spacers between each seal and the straight edge.

3.2 Axial Seals

The procedure for setting axial seals is identical to that described above, for the cold end radials, except there is no center splice in the straight edge. The finger tabs are set tight to the face of an axial seal plate hot and cold ends. The heater is then rotated and discrepancies observed. If axial seal plates are concentric within or close to nominal tolerances, then the straight edge is set up tight to the finger tabs with your selected seal setting spacer between, and tightened into position. The finger tabs are then rotated (moved) away from the straight edge by a dimension equivalent to the seal setting dimensions from the chart in this O&M manual and tightened. The seal straight edge is then moved tight to the finger tabs and fastened in place. You are now ready to set axial seals using your seal setting spacers between the straight edge and the seals.

Rev	Date	Description	Revision	Approval
0	12/9/05	Original draft created by Harlan Finnemore (Field Service Engineer, APCO) clarifications added by Bret Kent (IPSC)	HEF	BK